WASHINGTON
SCIENCE TRENDS

HIGHLIGHTS

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A Nuclear Navy ?

Admiral Hyman G. Rickover may have singlehandly won over a key Congressional Committee to support his view that all Navy combat ships of more than 8,000 tons should be nuclear-powered. In addition, he has forced through Navy channels an official paper which may scuttle complaints that such ships must cost several times more than those on conventional power.

✓ "I Got Pretty Fed Up" -- In secret testimony before the House Armed Services Committee, now available, Rickover explains:

"Until half a year ago, figures were being bandied about in the Navy Department indicating that nuclear power increased the cost of a ship two times, three times, or even four times. I got pretty fed up with this so I asked (Adm. Arleigh Burke, Chief of Naval Operations) to arrange a meeting with his top admirals...Admiral Burke followed through by having a detailed study made (which) confirms that the cost of nuclear powered surface ships is about one and one-half times that of conventional ships having comparable military characteristics."

✓ "Cheaper in the long run" -- Rickover also told the committee:

"I believe if you made a thorough and realistic comparison of the ultimate cost of nuclear versus conventional ships you would probably find the nuclear to be cheaper in the long run. This would be even more apparent if the studies were based on wartime operations rather than peacetime conditions.

"So far we have talked only about cost. We haven't talked about the greater military advantage a nuclear-propelled ship has. Yet even on a cost basis I think if you were to take into consideration the number of additional tankers you would require, the steel required for building the tankers, the escort vessels, the facilities, the additional manpower and so-on, I believe you would actually save."

✓ Costs Continue to Decline -- Here are figures submitted by Rickover showing the approximate reduction in cost and increases in lifetime between the first nuclear cores for a given-type submarine, and those bought last year:

	Cost Decrease	Life Increase
Nautilus-type core	20%	100%
Skate-type core	40%	20%
Skipjack-type core	60%	20%

"Even though the price for practically all military items is going up," the Admiral points out, "nuclear plant costs have come down...But we can't have such reductions unless we build some ships and let industry and shipyards gain some experience. We are not going to get costs down by just doing paper work and always talking about it, and always putting it off until next year." Congress may agree.

* AIRCRAFT EMERGENCY ESCAPE SYSTEMS

The U. S. Army Aviation Board is interested in finding a reliable emergency escape system for the VTOL/STOL aircraft of the future. Army officials expect that in any future conflicts the Army aviator will fly a large percentage of the time at treetop level and slow speeds. This will require an optimum escape system with an O/O capability -- a safe ejection at zero airspeed and zero altitude.

Desirable features of such a system, as outlined by the Army:

✓ G forces within human tolerance limitations.
✓ Escape capability to match the entire aircraft "envelope."
✓ Controlled stability during ejection.
✓ Automatic retention and release without crew pre-positioning requirements.
✓ Positive seat-man separation.
✓ Survival equipment integrated to crewman's harness.
✓ Simplified inspection and maintenance, with maximum reliability.

* WHY BASIC RESEARCH ?

An Associate Director of the National Bureau of Standards, I. C. Schoonover, has advised the House Committee on Science and Astronautics on some of the costs of not funding basic research programs. Speaking of the need for information on material performance under severe environment, he declared:

"In most instances we have not had sufficient understanding of the basic properties of matter to even provide the basis for reasonably good guesses as to the type of material that might have a chance of survival under some of these new conditions. As a result, we have had to resort to costly crash programs such as that engaged in to explore the potential of titanium and its alloys as high temperature structural materials. It is estimated that over a billion dollars was spent on this single materials effort. Currently, the Federal Government is spending in excess of $100 million annually in a crash program to obtain data on the refractory metals. Such costly efforts will have to continue until basic information on the behavior of matter and materials in these new environments can be obtained."

Note: It is estimated that somewhat less than 8% of the total national materials effort can be classified in the category of research solely for purposes of obtaining new knowledge.

* POSTDOCTORAL FELLOWSHIPS

Applications will be accepted through September 5, 1961 in the National Science Foundation's Postdoctoral Fellowship Program. Awards will be made in the mathematical, physical, biological and engineering sciences, and anthropology, geography, psychology, economics and the history and philosophy of science. Also included are interdisciplinary fields among two or more sciences such as oceanography, meteorology, biochemistry, biophysics and geochemistry.

Applicants must be citizens or nationals of the U. S., must possess special aptitude for advanced training and must hold the doctoral degree or have equivalent education and experience. Stipend of $5,000 per year, plus dependency allowance and a limited travel allowance will be available. Successful applicants may engage in study and/or research at any appropriate non-profit institution in the U. S. or abroad.

(Applications materials may be obtained by writing to the Fellowship Office, National Academy of Sciences, 2101 Constitution Avenue, N. W., Washington 25, D. C.)

* CURRENT BRITISH RESEARCH

Here is a review of current British research projects in a number of fields which may be of interest in the U. S., according to a report issued this month by the Department of Scientific and Industrial Research:

✓ Proposed New Programs: Britain's National Physical Laboratory plans a research and development program on high speed digital computers to be carried out as a cooperative effort with industry. A research reactor for standards work and basic studies was also proposed, but this has been delayed in view of a more urgent requirement for a Van de Graaf electrostatic generator.

✓ High Pressure Studies: An ultra-high pressure apparatus built by the National Physical Laboratory to a modified American design is being used to carry out studies of the effect of pressure on the resistivity of semiconductors, and has produced coesite -- a dense form of silica -- and some very small artificial diamonds.

✓ High Polymer Studies: Work is continuing on the measurement of dielectric properties and low frequency dynamic properties of polymers, which are widely used in plastics, synthetic rubbers and fibers.

✓ Automation: First steps have been taken "with encouraging results" towards the building of an exceptionally fast analog computer which could be used for the control of complicated industrial processes, such as the distillation column in an oil refinery, or other plants where "learning" as the inputs and demands change could be of value. Work is also going forward on the development of the planar cryotron as a computing component which gives promise of higher speeds, greater reliability and smaller size for computers of the future. Other work includes the mechanical translation of scientific Russian into English, automatic retrieval in libraries and automatic reading of both printed and handwritten numerals.

✓ Noise Measurement and Control: Plans call for a considerable expansion of current research programs. Meanwhile, subjective tests on motor vehicle noise are being made, aimed at the design of an instrument which will give a physical measurement of subjectively-assessed noise for a wide range of vehicles. Subjective tests on jet and piston-engined aircraft have been carried out and the results published, and helicopter noise has also been studied.

✓ Ground Effect Machines: Basic research on ground effect machines, or "Hovercraft" will be started soon for Britain's Ministry of Aviation. No attempt will be made in this program to design an actual craft, but fundamental data on design and performance will be made available to firms proposing to enter the field.

✓ Absolute Light Standard: Attempts have been made during the past year to measure light as a "visually weighted" radiation, or radiation which has been passed through a filter transmitting, at every wavelength, a fraction proportional to the sensitivity of the eye at that wavelength. First results were "very encouraging." Researchers may soon be able to propose the application of an absolute radiometric method to the measurement of light. A small group has been formed to study lasers, powerful new sources of nearly monochromatic light obtained by stimulating emission in fluorescent crystals. The aim will be to find out what factors control the light output and to build experimental lasers for pulse and continuous operation, which can be used in new applications.

(Details in "Report of the National Physical Laboratory for 1960, Department of Scientific and Industrial Research," to be available in the near future at $1.71 from British Information Services, 45 Rockefeller Plaza, New York 20, New York)

TECHNICAL TRENDS

□ The Patent Office is regrouping its classification of some 20,000 U. S. and foreign patents relating to drilling or boring holes in the earth. Information is available in Patent Office Classification Bulletin No. 440 available at $1 from the Publications Office, U. S. Department of Commerce, Washington 25, D. C. √√√ Navy officials have advised Congress that the cost of the Subroc guided missile which is to be fired from submarine torpedo tubes against enemy submarines will eventually run to $100,080,000. Current development includes a depth-bomb warhead, but future plans will probably include a torpedo warhead and also an air-burst capability. √√√ While the Navy has been forced to kill plans for the Eagle/Missileer system which envisioned an aircraft with long endurance capability and long-range missiles the Air Force is thinking of a similar concept as an alternative to the B-70 -- the so-called Dromedary program calling for an aircraft with boundary layer control which would be fitted with an air-launched ballistic missile such as Skybolt and remain in the air outside enemy defenses for long periods of time. √√√ Army Engineers have called for bids for a test facility for captive firing of solid fuel rocket motors developing large thrust at Redstone Arsenal, Ala. First planned use of the new facility will be captive firings of motors for the Nike Zeus antimissile missile.

□ The Joint Committee on Atomic Energy, F-88, The Capitol, Washington 25, D. C. plans to hold public hearings June 12 to 15 on radiation safety and regulation. √√√ The three armed services have signed a new $250,000 contract with the Electronics Research Laboratory at the University of California, Berkeley, Calif. which "will insure that every graduate electronics student eligible for financial support will receive it in the form of part-time salary, technical services or both." √√√ The Air Force is interested in receiving "private comments" on procurement policies which might be required five or ten years in the future. Send your ideas to AFMPP-PR-4, Headquarters, USAF, Washington 25, D. C. √√√ The results of a considerable number of VHF-UHF field strength recording projects conducted at Federal Communications Commission monitoring stations (Report T.R.R. 2.4.18) is available from FCC Technical Research Division, Room 2216, New Post Office Building, Washington 25, D. C. √√√ Information on the calibration of platinum resistance thermometers, and test fee schedules may be obtained on request from the National Bureau of Standards, Office of Technical Information, Washington 25, D. C.

□ The Air Force is sponsoring construction and operation of a National Magnet Laboratory at the Massachusetts Institute of Technology as an international center for the study of magnetic fields. Construction starts this summer, with full operation scheduled for 1963. √√√ The General Electric Co., Power Tube Department, Schenectady, N. Y. has produced a vapor thermionic converter with a 15 to 17 percent efficiency for possible space and military applications. ITT Federal Laboratories, Nutley, N. J. has delivered to the Navy two lightweight atomic frequency standards -- so-called "atomic clocks" -- known to be accurate to less than one second variation in 300 years. Such equipment is expected to be of value in submarine navigation, missile guidance and other high-precision tasks. √√√ The Army is thinking of establishing a Geophysical Institute to coordinate and control all Army research in the earth sciences. √√√ Details of the proposed $1.23 an hour minimum wage determination for the Electronic Component Parts Industry are available from the Public Contracts Division, U. S. Department of Labor, Washington 25, D. C. √√√ Preliminary tests are underway at the 1-million-gallon per day saline water conversion demonstration plant established by the Interior Department at Freeport, Tex.

□ A detailed breakdown on the record increase in exports of precision instruments from the United States during 1960 is available from the Scientific Instruments Division, BDSA, U. S. Department of Commerce, Washington 25, D. C. Ask for Announcement BD-61-88. √√√ The Navy is developing an antisubmarine warfare prediction system (ASWEPS) to enable fleet units to take synoptic measurements leading to improved sonar condition predictions.

* LARC PROBLEMS

Here are some of the problems to be investigated at the U. S. Navy's David Taylor Model Basin with the aid of the Remington Rand Univac LARC solid state computer:

✓ Simulation of the lifetime behavior of mathematical models and the calculation in hours of the performance of the various components during the power producing life of a nuclear reactor core.

✓ Development of a digital method for spectrum analysis of ocean wave patterns.

✓ Calculations related to the design of large arrays of transducers.

✓ Automatic control of heavy machine tools used to fabricate ship components.

✓ Calculating ship forms rather than laying them out full scale in a builder's loft.

✓ Analysis of magnetic fields for minesweeping operations.

✓ Development of a method of underwater sound analysis based on ray tracing.

* REFRACTORY SHEET METAL PROGRESS

U. S. efforts to develop refractory metal sheet for high temperature applications in rocket engines and the skin of reentry vehicles has been most successful with molybdenum, according to specialists at Battelle Memorial Institute. They report:

✓ Columbium sheet development is progressing well and performance is expected to equal that of molybdenum in a few years -- although it will probably remain more expensive for a somewhat longer time.

✓ Reentry glider leading edge requirement has encouraged strong competition between sheet columbium and molybdenum alloys for use up to 2500°F. Above this temperature, designers probably will have to go to sheet tungsten and tantalum alloys, which are not in as advanced a state of development. Tantalum is said to be the most promising of the two at the present time because of superior sheet producibility and low-temperature ductility.

✓ Primary problem with refractory metals for all high-temperature applications is oxidation. Recent laboratory tests have raised the hope of solving the problem through the development of satisfactory coatings -- at least for the leading use of molybdenum and columbium. For the columbium alloys, aluminum-silicon dipped and sprayed coatings and aluminum-oxide base coatings have shown encouraging results. The best molybdenum coating has been of a cementation type, designated W-2. During fabrication of refractory metals, zinc coatings (as previously reported) have shown promise as a self-healing protective coating up to temperatures of 2000°F.

Note: Tungsten and tantalum are receiving special attention for forgings needed in solid propellant rocket engines, and for sheet applications in all types of rockets.

* PROJECT RELAY CONTRACT

Extensive experience in traveling-wave tubes, as well as other operating hardware and components was apparently a key technical factor in the award to Radio Corporation of America of a $3-$4 million contract for development of an experimental Project Relay active repeater communications satellite. Still to be determined by the National Aeronautics and Space Administration are such details as the method of stabilization of the satellite, and a decision as to whether a "back-up" traveling-wave tube should be incorporated in the final design. First launch is scheduled in the Spring or Summer of 1962.

P U B L I C A T I O N C H E C K L I S T

- ☐ HIGH IMPACT METAL FORMING, a Lockheed Corp. bibliography for the Air Force, now generally available. Informative abstracts of some 130 technical articles and publications in this field. 37 Pages. (Report LMSD-703045 ((PB 171 379)) available through military channels or at $1 from OTS, U. S. Department of Commerce, Washington 25, D.C.)

- ☐ METALLURGY OF HIGH-STRENGTH STEELS, a brief review of developments in this area as noted during the period January 1 to March 31, 1961. 2 Pages. (Single Copies Free to Government agencies, contractors, subcontractors and their suppliers. Write Defense Metals Information Center, Battelle Memorial Institute, Columbus 1, Ohio for DMIC Memorandum No. 100)

- ☐ SPACE PROPULSION TECHNOLOGY, a transcript of hearings, testimony and exhibits from Government and Industry covering a wide variety of developments in propulsion for space missions. 228 Pages. Single Copies Free. (Write Committee on Science and Astronautics, New House Office Building, Washington 25, D. C. for Hearings -- Space Propulsion Technology)

- ☐ PATENT POLICIES -- HEW, an analytical history of the patent policy of the Department of Health, Education and Welfare with information on current procedures and some special attention to arrangements with nonprofit institutions. 93 Pages. (Single copies free as available from Subcommittee on Patents, Committee on the Judiciary, U. S. Senate, Washington 25, D. C. or at 30 cents from Superintendent of Documents, Government Printing Office, Washington 25, D. C. Ask for Patent Subcommittee Study No. 27)

- ☐ PRACTICAL APPLICATION OF SPACE NUCLEAR POWER, an excellent report from Atomics International, a division of North American Aviation, for the Atomic Energy Commission. This material was originally presented before the International Astronautical Congress which met at Stockholm, Sweden, in 1960. 50 Pages. (Report TID-6312 available through AEC channels or at $1.25 from OTS, U. S. Department of Commerce, Washington 25, D. C.)

- ☐ PETROLEUM REFINERIES AND CRACKING PLANTS, an official summary of refinery capacity in the U. S. by years from 1930 to 1960 and by districts and states on January 1, 1960, with similar information on cracking plants. 13 Pages. 20 Cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D. C. for U. S. Bureau of Mines Information Circular No. 8009)

- ☐ CHEMISTRY FOR THE SAFETY MAN, a bulletin for industry providing basic information on chemistry to aid in controlling chemical hazards. 25 Pages. 15 Cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D. C. for Publication No. L 16.3:222)

- ☐ AIRCRAFT EXTRUDED SHAPES AND DIES, a military handbook for the guidance of engineering and technical personnel covering extruded shapes used as structural members in U. S. aircraft and missiles, including reference numbers. 1,362 Pages. $6. (Write Superintendent of Documents, Government Printing Office, Washington 25, D. C. for Publication D7.6/2:301, Military Handbook of Aircraft Extruded Shapes and Dies No. 301, July 1, 1959)

- ☐ SURVEY OF ALTITUDE MEASURING METHODS, an evaluation by the National Aeronautics and Space Administration of a number of altitude measuring methods which might be used for the vertical separation of aircraft. A static-pressure compensator-computer system appears to be favored. 39 Pages. Single Copies Free. (Write National Aeronautics and Space Administration, 1520 H Street, N. W., Washington 25, D. C., ATTN: CODE BID for NASA Technical Note D-738)